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AN APPRAISAL OF RICE DRYING STORAGE, PROCESSING, AND MARKETING IN THE PHILIPPINES

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Summary

This report presents a brief appraisal of the commercial rice industry as related to improving efficiency and expanding domestic and export markets. The central issue is the evaluation of the possibilities of developing export markets for Philippine rice.

The world rice shortage and high rice prices which existed in the 1965-67 period have ended. World rice prices have declined 20 per cent. Current world rice prices f. o. b. exporting ports are around $200 per metric ton for high-quality long-grain rice and $145 to $160 per ton for the lower-quality types. Prices could decline an additional 20 per cent in the next year or two, or to a level of from $160 to $180 per ton for high-quality rice and $120 to $140 for lower-quality types. At these prices, however, there is likely to continue to be an international market for rice.

Generally, the commercial milled rice in storage and being milled in the Philippines was found to be too low in quality to meet export standards in normal world markets. The major factor affecting export quality was excessive broken grains. While export markets require a minimum of 5 to 10 per cent broken grains, the usual milled rice of the Philippines contained 30 to 50 per cent brokens. Other factors affecting quality when selling abroad included excessive chalky kernels, heat-damaged kernels, mixtures of varieties, and the dull color of the grain.

Philippine rice can be improved to meet export quality standards. In order of priority, this can be done by (1) adjustments in rice mills, (2) improvements in drying practices, (3) changing storage methods,

(4) programming varieties produced, (5) development of training programs, (6) implementation of quality standards, and (7) adjustments in under-utilized resources. Specific suggestions have been made as to the adjustments needed in each of these broad areas.

The possibilities for developing an export market for Philippine rice depend on price policy as well as improvements in export quality. The current support price of 16 to 17 pesos per 44 kilo-cavan along with the minimum retail price of 1.40 pesos per ganta results in a substantial subsidy to the grower, or consumer, or both. At the present support level, milled rice could only be exported at a loss. Assuming world prices hold steady, a subsidy of up to $20 per ton or 4 to 6 pesos per cavan would be required.

At projected world prices for the next few years of $120 to $140 per ton for medium-quality rice and $160 to $180 for high-quality rice, the Philippines has several alternatives:

1. To eliminate all price supports, permit prices to be established by supply and demand, and compete at world export prices to the extent supplies are available. Growers would of necessity have to accept lower prices and the commercial trade would need to reduce costs and improve quality to compete in export markets.
2. Export rice at competitive world prices while holding domestic prices at near current levels. This would mean a government subsidy of 4 to 6 pesos per cavan for that part of total production exported.

3. Attempt to maintain a position of self-sufficiency in rice, maintaining some buffer stocks for lean periods, but as production increases, encourage diversion of marginal rice lands to other uses.

In some respects the Philippines is in a more favorable position to take the first alternative than most other countries in the area. The Nation has certain major economic advantages for the production of high-quality rice that are not enjoyed to the same extent by other nearby countries. To take advantage of these opportunities, however, a viable, efficient rice exporting industry must be established and maintained, and rigid quality control measures implemented. Suggestions have been made as to how to establish this export business and how to maintain the needed quality control.

AN APPRAISAL OF RICE DRYING, STORING, PROCESSING, AND MARKETING IN THE PHILIPPINES*

By

J. Norman Efferson and Klaus Sengelmann

This report presents a brief appraisal of the rice drying, storing, processing, and marketing industry of the Philippines as related to the prospects for improving efficiency and expanding markets. The authors do not pretend to be experts on the Philippine rice industry. What they have attempted to do is to gain an overall picture of the commercial rice industry and then to relate their experiences and observations in other parts of the world to make certain observations and conclusions on the Philippine industry.

The overall picture of the commercial rice industry was obtained during the September 29 to October 25, 1969 period by the following approaches:

1. By visiting some of the major commercial centers of the rice industry in Mindanao, Cebu, and Luzon.
2. By observing the operations of numerous rice mills, warehouses for storing palay and milled rice, drying plants and drying centers, by-product processing plants, and allied service industries in these areas.

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3. By interviewing rice millers, dryer operators, warehouse managers, wholesale buyers, cooperative managers, Rice and Corn Administration area managers, and others involved in the commercial processing, drying, storage, and marketing of rice.
4. By examining manufacturing facilities for the production of rice drying, storage, and processing machinery and allied equipment in Cebu City and the Manila areas.
5. By conferring with major leaders in the rice trade and in the administration of national and regional rice programs in both the public and the private sectors.
6. By studying market conditions and market trends in various wholesale and retail rice markets in all areas visited.
7. By contacting farmers and farm leaders and discussing with them their current drying, storage, processing, and marketing problems.
8. By interviewing research and training people involved in rice production, processing, and marketing at The International Rice Research Institute and the University of the Philippines College of Agriculture, Central Luzon State University, Maligaya Experiment Station and Central Rice and Corn Institute, and various government offices in Manila.

9. By reviewing current publications and reports on subjects related to the rice drying, storing, processing, and marketing industry.

Throughout the study period, the authors were graciously received everywhere and were given the fullest possible cooperation in every way. To the many individuals who assisted in making the study a very pleasant and educational experience, the authors are truly grateful.*

Every type of rice dryer used in any part of the rice world, from the conventional sun or solar dryer, sack dryers, flat batch dryers, upright or columnar-flow batch dryers, non-grain-mixed and mixed-grain continuous flow dryers, to systems of continuous flow dryers combined with aerated dry-and-store-in-place units, and even the experimental infra-red dryer were found in the Philippines. In storage practice, there is much conventional sack storage, a small amount of bulk storage in flat warehouses, and some bulk storage in the different types of tanks and silos. In milling, there is everything from the mortar-and-pestle approach, the small community kiskisan one-pass two-product mill, modified kiskisan mills producing three

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or four products, cono mills of all types, to the most modern rubber-roller sheller, polishers in tandem, finishing whitener, and grain classification equipment.

In one of the numerous conferences held with leaders of the industry the statement was made that the Philippines has everything that is needed for a prosperous rice industry except money -- that all that is needed is capital. There is much truth to this statement but in many cases sufficient capital is the result of an efficient profitable business rather than a cause of making the business profitable. It is true that the Philippines has every type of dryer, warehouse, and rice mill that exists anywhere in the world, and has the specialists to construct and operate all of these different items and systems.

Although the Philippines has a wide range of equipment and much technical know-how to maintain a maximum-profit rice industry, the utilization of these resources and the priority values placed on different approaches can be adjusted to improve the profit position of the industry and to make rice growing more profitable to the farmer and good-quality rice more available to the consumer. It is in this area -- how to use what is available and what to emphasize first, second, and third -- that attention will be centered.

The central issue of this paper is the question of whether or not the Philippines should attempt to develop an export market for rice. Basic to this central issue is the quality aspect of Philippine

rice for both domestic and international markets. Domestic price policy as it relates to world rice prices is also involved in this analysis as well as the technical adjustments needed in the rice industry with an increasing volume and potential export markets.

Should the Philippines Develop a Rice Export Business?

The current rice position of the Philippines has been the subject of several analysts in recent months. A paper by Drilon and Goldberg(1) is outstanding in this respect. This carefully-documented review points out the recent history of the Philippine rice industry, the impact of the new varieties along with expanded extension efforts, plant protection, additional fertilizer, additional credit, cooperatives, and price-support programs for increased production, and the fact that the Nation has reached the point of self-sufficiency. It raises the basic question as to whether the nation's objective should be to maintain a position of self-sufficiency or to become an active exporter of rice. The Weitz-Hettelsater Report is another example of a recent comprehensive analysis.(2)

The approach here will be to appraise the short-time and long-time international rice market, to look at the current position of the Philippine

(1)Notes on The Philippine Rice Industry, by Jose D. Drilon, Jr., and Ray Goldberg. UPA-2, The Inter-University Program for Graduate Business Education in the Philippines, Manila, March 25, 1969.

(2)Storage, Handling, and Marketing of Selected Crops in the Philippines. Weitz-Hettelsater Engineers, Kansas City, June, 1968.

rice industry as related to this market especially in the area of competitive rice quality, and then to point out the specific adjustments in the use of existing resources and in the priorities where choices must be madé so as to develop maximum efficiency. In this respect, the specific adjustments suggested are applicable to the Philippine rice industry regardless of whether or not it moves into export markets. The history of other major-consuming rice areas is that when they shift from a deficit to a self-sufficiency or a surplus position, consumers become much more discriminating as to quality and much more flexible in their buying habits. Thus, many of the adjustments suggested will be necessary regardless of the export position of the country as a whole.

Possible World Markets for Rice

Prior to World War II, the French Indo-China complex (now Laos, Cambodia, and North and South Vietnam) was the largest exporter of rice, shipping around 2 million tons annually with a large part of this volume going to Europe as livestock feed. After the war, Burma became the largest exporter, shipping between 1.5 million and 2.0 million tons annually, with most of it being sold in Asia (India, Ceylon, and the Philippines), but with some of this volume being marketed in Latin America and Europe. In the late 1950's and early 60's, exports from Burma gradually declined and Thailand became the largest exporter, shipping from 1.5 to 1.8 million tons annually. Thailand was closely followed by Burma with the United States

increasing in importance to reach the third position marketing between 0.5 million and 1 million tons annually. In this period Mainland China, by following a policy of importing wheat at a lower cost as a substitute for rice, became an important exporter of rice.

In 1967, the United States became the largest exporter of rice, shipping 1.7 million tons including 1 million of commercial private-enterprise sales and .7 million tons of government-financed shipments. This level increased to 1.9 million tons in 1968 and in 1969. In this most recent period, Thailand has been the second most important exporter, selling 1.2 to 1.4 million tons annually. Mainland China, continuing its policy of buying wheat and exporting rice, exported about 1.0 million tons annually. Burma's export shipments in this period averaged around 0.5 million tons a year.[3]

World rice production increased from 241 million metric tons of palay in 1966 to 269 million tons in 1967, and 272 million tons in 1968. This amounted to an increase in excess of 10 percent from 1966 to 1967, but an increase of only 2 per cent between 1967 and 1968. All ten of the world's leading producers of rice registered increases in production in the 1966-68 period. The Philippines, ranking ninth in world total production, increased total palay production from 4.16 million metric

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(3) The Rice Situation, 1969. U.S. Department of Agriculture, Washington, D.C., RS-13, March, 1969.

tons in 1966 to 4.5 in 1967 and 4.6 in 1968.[4]

It should be noted that rice production increased 14 million tons from 1966 to 1967 in India and did not increase further in 1968, and increased 4 million tons in Mainland China from 1966 to 1967 and did not increase further in 1968. These increases were due in part to favorable weather conditions in 1967 and 1968 as compared with unfavorable weather in 1966. Although the relative impact of weather conditions on world rice production in the 1967-68 period as compared with the impact of the new varieties and additional inputs is a subject of some controversy, it should be kept in mind that a large part of the substantial increase in production occurred in countries where the new varieties were not in major use. The increase, therefore, was most likely due at least in part to changes in climatic conditions, mostly to additional rainfall. In the Philippines, the same factor was important, although a large surplus was initially expected in 1968, it did not materialize because of drought conditions in some areas. So long as most of the rice lands of Asia are dependent on natural rainfall, without controlled irrigation for water supplies, the weather will continue to be the most important factor affecting total rice production. With the widely-variable weather conditions from year to year, the 1967-69 situation of relative plenty could be rapidly reversed with only one bad weather year.

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(4) World Agricultural Production and Trade, Foreign Agricultural Service, United States Department of Agriculture, June, 1969.

World trade in rice is a very small part of total production. In the 1967-69 period, only about 7 million tons of milled rice moved from one country to another. This represented less than 4 per cent of total world production. Thus small changes in supplies result in large changes in export prices. Within the Asian region, the approximately 2 million tons which was traded each year between nearby countries has remained relatively constant. This leads to the observation that any newly-developing export supplier of rice in the region will have difficulty in competing for these markets.

In general, the drastic world rice shortage which existed in the 1965-67 period has been changed to a position of supplies at least keeping up with population growth and in some areas a build-up of surpluses. The international rice market has changed from a sellers market in 1966 and 1967 to a selective buyers market in 1969. Importers have become more discriminating as to quality, specifications, insect infestation, and delivery dates.

Some analysts have been very pessimistic as to the future of export markets for rice. A recent FAO report[5] indicates that the new varieties are pushing many countries in Asia to self-sufficiency or surpluses and that there is little opportunity for developing markets outside the area. This study indicates that by 1975 there will be

(5) Summary of a recent report from the Food and Agriculture Organization as quoted by The Manila Times on October 19, 1969.

very few export markets for rice. Another study[6] indicates that the main forces leading to lower trade and lower rice prices will be most pronounced in the next five years and that by 1975 and beyond there is likely to be a significant recovery in the level of rice trade and world prices for rice. This more optimistic view of the long-run situation was based on the assumption that the recent major increases in production will not be maintained because of the impact of lower prices on production, lack of needed inputs, and water shortages. Still another recent study[7] indicates that with the recent changes in production there is still no massive world surplus of rice in sight and that the world situation is one in which rice markets have adjusted from the recent pattern of high prices and scarce supplies to one of generally adequate exportable surpluses and significantly lower prices.

World rice prices reached a long-time high in mid-1967; Thailand 5% brokens, long-grain sold for more than $250 per metric ton f. o. b. Bangkok. From mid-1967 to the end of 1968, the price dropped sharply to reach about $180 per ton. Since that time prices have stabilized and this same quality rice has been selling for between $180 and $200 per metric ton. The price on September 29, 1969 was $187 per metric ton. The lower qualities, 25% brokens long-grain sold for $160 per ton, parboiled 10% brokens long-grain was priced at $145 per ton, and A-1 quality 100% broken rice sold for $92 per ton, on this same day. Table 1 shows a summary of the above price information.

(6) Production and Trade Prospects for Rice and Corn in the 1970's: A Southeast Asian View, by Martin E. Abel, Asia Society Rural Development Seminar, East-West Center, Honolulu, Hawaii, June, 1969

(7) "Asia Changes & The World Rice Market," by Clarence E. Pike. Foreign Agriculture, United States Department of Agriculture, Washington, D. C., August 11, 1969.

Table 1

Price of Rice by quality and type in Dollars per ton, Bangkok, Thailand, for Selected Periods

Quality and type	Bangkok F.O.B. Rice Prices		
	Mid-1967	End of 1968	Sept. 1969
	Dollar/metric ton	Dollar/metric ton	Dollar/metric ton
5% broken -long grain	250	180	187
25% broken -long grain			160
Parboiled 10% broken-long grain			145
A-1 100% brokens			92

World rice prices will react in the future as they have in the past -- they will go up and down. The chances are that the most pessimistic forecasts of massive surpluses, very few markets abroad, and greatly depressed export prices will not materialize. The continued increase in population and higher standards of living will expand total demand. Bad weather years will continue to occur occasionally. Not all farmers will shift as rapidly to the new varieties and the use of increased inputs as the early innovators. Much of Africa is gradually becoming a more important market for rice and their production potentials are not bright. Some of the Asian nations may find it cheaper to produce other items and import their rice. The largest exporter, the United States has imposed significant acreage reductions. On the other hand, the 1969 level of

rice prices and demand is not likely to exist for any extended period of time. In planning for rice exports over the next five years, an assumed price level at the present level of world prices to a level 20 per cent below the present price is considered to be realistic.

In the Philippines can produce and process the higher-quality types and sell them f. o. b. Philippine ports at from \$160 to \$180 per metric ton, the lower-quality types at from \$120 to \$140 per metric ton, and good quality broken grains at \$70 to \$90 per ton, then the prospects are good for developing a sound export rice business in the 1970-75 period. If not, then the basic rice policy should be geared to self-sufficiency with some carryover to be used in the lean years.

The Quality of Philippine Rice

A kilo of milled rice contains about 3600 calories of food energy and is about 7 per cent protèin. Although there are minor variations, this is generally true regardless of whether the kilo of rice is 100% long-grain highly-translucent non-chalky and free from all other types and foreign materials or whether it is 50 per cent broken grains with some yellowish grains, contrasting types, and foreign materials, or whether it is 100% broken grains.

However, consumers distinguish greatly between different qualities of rice and pay widely-differe: - prices according to their evaluation of quality. In the Philippines, consumers have different standards of quality than in most other areas. Market practices in the Philippines reflect this difference in quality preferences. Many individuals not familiar with consumer demands in other countries

have assumed that because Philippine rice was readily accepted by local consumers, it would be equally acceptable on international markets. As has been found in the initial exports of rice from the Philippines in 1968, this assumption was not valid.

As of October, 1969, Intan, C-4, and Wagwag, fancy and special varieties, were selling at wholesale in the Manila market for 50 to 51 pesos per cavan. IR-8, the most common ordinary variety was wholesaling at 46 to 47 pesos per cavan, with first grade milling. At the retail level, prices for the fancy and special types averaged 2.20 pesos per ganta as compared with 1.90 to 2.00 for IR-8 and slightly lower for some of the other ordinary types. Generally, there was a difference of about 10 per cent in price from the fancy and special varieties to the ordinary varieties. Rice markets observed in Mindanao, in Cebu, and in various areas in Central Luzon and in Baguio all had the same general difference among the fancy, special and ordinary types. The general level of prices is lower in Mindanao than in Manila, about the same in most of the markets in Central Luzon, and the prices in Baguio were significantly higher than in Manila.

The authors collected more than 200 typical samples of milled rice of the different types and qualities in the markets and in the mills visited and examined these as to general quality and variations in quality. A small proportion of the samples had a broken grain percentage estimated roughly as low as 15 to 20 per cent (this was usually the special or fancy varieties), the average broken grain percentage was around 35

per cent, and some of the milled rice samples had more than 50 per cent broken grains (this was usually IR-8 or the other ordinary varieties).

The variation in price of around 10 per cent between the relatively high and the relatively low quality milled rice at both the wholesale and the retail level appeared to be associated with two factors; the variety and the percentage of broken grains. The higher-quality types were usually whiter, more flinty, frequently long-grain, and had certain special aromatic or taste characteristics; the lower-quality varieties were usually although not exclusively the short-grain type, were chalky, and had a dull color. These are the same general quality differences that are most important to consumers in other rice-consuming areas.

The general level of quality, however, and the amount of variation between prices for low-quality as compared with high-quality rice was greatly different fromthat which is common in many other rice-consuming nations, and especially those which import rice. Of the more than 200 samples of milled rice collected, not a single sample was sufficiently high in quality to be acceptable in normal world export markets. This basic fact must be clearly understood by the Philippine rice industry if it is to make a feasible start towards becoming an exporter of rice. In addition, it must be as clearly understood that the price difference between good quality and poor quality rice is much greater in international

markets than the indicated 10 per cent difference in the Philippines. The spread between good quality and poor quality rice is likely to be between 25 and 40 per cent on international markets.

Factors Affecting the Quality of Philippine Rice

The most important factor causing the samples collected to be sub-standard by international standards was the percentage of broken grains. Only about 10 per cent of the samples examined had an indicated broken grain content of less than 20 per cent, most were in the 30 to 40 per cent range, and some were higher than 50 per cent. Also, a considerable part of the broken grains were of the smaller sizes, one-fourth grain or less, which is especially objectionable in most international markets. The most popular grade of Thailand rice for export sale is their fifth grade from the top, White rice 5%, in which the broken grain tolerance is a maximum of 5 per cent, with no grains smaller than one-third size. The top quality United States grade, no. 1, which is marketed in Europe, Singapore, and Hong Kong, has a maximum broken grain tolerance of 4 per cent. The standard United States export grade which is shipped abroad in greatest volume, U.S. #3, has a maximum broken grain tolerance of 15 per cent. Australian, Egyptian, and Italian export grades have similar grain tolerances as those of Thailand and the United States.

The second most important factor affecting quality by international standards was the content of chalky kernels. Top grades

of milled rice permit a maximum of 2 to 4 per cent of the grains to have a chalky or milky appearance on part of the grain, and standard export grades have a maximum tolerance of only 4 to 6 per cent. Most of the IR-8 observed had 35 per cent or more chalky grains, and even Intan and C-4 had more than the 6 per cent maximum considered desirable for export trade.

The third most important factor was heat-damaged kernels. These kernels show up in milled rice as yellowish grains. International grade stadards permit only 2 such grai ns per kilo of rice in top grades and only 10 per kilo of rice in standard export grades.

The fourth factor was mixtures of other varieties. Usual export standards for top quality types permit a maximum of 1 per cent of rice of other classes, and for standard quality such as the U.S. no. 3 grade, only 3 per cent.

The fifth factor was the general color of the grain. International markets require that good quality rice be white or creamy in color and that it be well milled. Lower quality export grades permit the color to be light grey and only reasonably well milled but under-milled rice and a dull grey or rosy color are generally not acceptable.

Other factors which occasionally affected the quality of the samples examined included - red rice or red-streaked grains, weed seed and other foreign materials, insect contamination, and musty off-type odors.

Many of the impurities described can be and are frequently removed by the typical cook in the Philippines by washing the grain one or more times before cooking and carefully picking out the large foreign materials. In many countries which import milled rice, the consumers are advised not to wash rice before cooking because the washing process removes a substantial part of the vitamins and minerals and some of the protein, all of which are concentrated in the outer layers of the grain. These countries will not import rice which is contaminated with foreign materials, dust, or insects so that it must be washed.

Generally, long-grain rice sells at a higher price in international markets than medium-grain types, and medium-grain sells for a higher price than short or round-grain rice. There are international markets, however, for all three grain types and some countries produce the medium and short-grain types for export because the higher yields per hectare and the higher milling yields obtained from these shorter-grain types more than offset the lower prices received. Overall, in most rice production areas, long-grain varieties such as Intan or C-4, have a higher percentage of broken grains than a medium-grain variety, such as IR-5, and in turn the medium-grain types have a higher percentage of broken grains than a short-grain variety, such as Binato or Wagwag.

Some international markets prefer parboiled rice. In this process, the palay is soaked and then steamed before being dried

and milled. The result is the movement of much of the vitamins and minerals from the outer layers throughout the grain where it cannot be milled off, and the healing of many incipient cracks in the grains so that a higher yield of whole rice and less brokens is obtained. The disadvantages are a slightly yellow to distinctly yellow grain color and a characteristic odor. However, where consumers prefer parboiled rice, which is true in East Pakistan, much of India, parts of Ceylon, parts of Malaysia, and some areas in Latin America, the somewhat lower international price that is characteristic of parboiled rice is occasionally offset by the higher yields of whole rice obtained from otherwise high-breakage low-quality palay. For instance, although practically no parboiled rice is consumed in Thailand, about one-fourth of the total annual exports of rice from Thailand are the parboiled types.

Suggestions for Improving the Quality of Philippine Rice

The overall quality of Philippine rice must be improved if maximum utilization of the recent increases in production is to be achieved. This is especially important if total production becomes greater than domestic consumption and part of the production must be sold elsewhere. Current indications point to a possible surplus position in 1970 and a gradually increasing surplus in the next 10 years. The estimates of a surplus of around 100,000 tons of palay in 1970, increasing to an annual surplus of around 1 million tons of palay by 1980 are optimistic, assuming normal weather conditions, additional high-yield varieties, and the availability of increased inputs. Production in

excess of domestic needs in some years should be expected. Even with the domestic consumption of rice in terms of palay increasing from the current level of around 4.6 million metric tons to about 5 million metric tons in 1970, 6 million metric tons annually by 1975, and 7 million tons a year by 1980, expected yield increases along with some area increases and more double-cropping will produce a surplus if continued attention is paid to the rice industry.

The necessity for improving the quality of Philippine rice has been well recognized by responsble Philippine authorities. During the 1967-68 period, a series of bulletins were issued outlining the steps needed to produce and sell high-quality rice to export markets. This series, issued by RCA, included:

<u>Palay Harvesting and Drying</u>
<u>Bulk Storage in Palay Bodegas</u>
<u>RCA Warehousing Plan</u>
<u>Salient Points of RCA Rice Exportation Plan</u>
<u>Rice Marketing in the Philippines</u>

These reports spell out that the production and marketing of export-quality rice is a systems operation in which each part of the system must be considered in relation to all other segments and in which the entire system is no stronger than the weakest link.

It is now appropriate to turn to an ordering of priorities. The major approaches recommended include: (1) adjustments in rice mills, (2) improvements in drying practices, (3) changing storage methods, (4) programming varieties produced, (5) implementation of quality

standards, (6) establishment of an extension education program for rice millers and warehouse operators, and (7) adjustments in under-utilized resources for more effective use.

Adjustments in Rice Mills

There are about 10,000 rice mills in the Philippines. These mills process practically all of the rice produced. Palay exports are not common and hand-pounding has gradually declined to 1 per cent or less.

A substantial part of the Nation's total rice production is milled in local "kiskisan" mills at the Barrio level. These mills process rice for local consumption and they receive payment in kind or payment at a fixed rate, varying from .8 peso to 1.5 peso per cavan, for all rice processed. This type of mill is reported to have a relatively low milling recovery of about 45 per cent by volume or 60 per cent by weight, and is considered by some to be inefficient. However, these mills exist primarily to serve farmers and rural residents earning palay by labor, financing, or other services, and are performing a necessary function that is not likely to be replaced by more efficient methods in the near future. These mills process about 55 per cent of the palay produced. There are more than 6,000 of them in the nation.

The remainder of the palay produced is processed in commercial "cono" mills for sale in larger volume in the local area where

produced, or sale to nearby city markets or distant markets such as Manila. Almost one-half of the total production of palay is processed in cono mills and in the large surplus areas such as Central Luzon and Mindanao, up to 80 per cent of local production is processed in such mills. The cono mills are more efficient than the kiskisan mills and produce generally at the rate of 51 per cent by volume or 64 per cent by weight of rice averaging about 35 per cent broken grains. The more efficient mills of this type produce up to 55 per cent by volume or 68 per cent by weight with about 30 per cent of the total rice being broken grains. There are more than 3, 000 of these mills with the average capacity being around 130 cavans of palay per 12-hour day, with some of the larger mills having a daily capacity of three to four times this level.

The typical cono mill consists of a palay cleaner, two composition-stone hullers, a shaker-separator, and two emery-stone polishers. The more sophisticated types include a third smaller huller to process the separated unhulled palay from the separator rather than running it back through the first hullers, and occasionally a third polisher used in tandem with the other polishers. It was observed that most of the cono mills operated the polishers as single-pass units, rather than as units in tandem.

The cono mills are manufactured by local rice mill machinery producers, using models developed in Europe about 30 years ago.

The mills visited did not have classifiers to separate broken grains from whole grains after milling or re-mixing equipment to produce milled rice of a specific broken-grain content. In all cases observed, the rice was bagged directly from the polisher, mill-run.

An idealistic approach to maximum improvement of the rice milling industry of the Philippines might be to eliminate all existing mills and start over again in clean new buildings with neat more efficient equipment. This would be foolish. Although the kiskisan mills are not likely to expand in number in the next few years, they will continue to serve a large part of the rural population. Although yields are relatively low, they serve many small units, use inexpensive family labor, and provide edible food from palay cheaper than the local farmer or laborer could obtain it by other means. The best approach to the kiskisan mills is to help them improve efficiency and let the pressures of increasing urbanization dictate when they will be replaced by more modern mills.

For the cono mills, the great majority, and especially those that serve consumers in nearby barrios and the smaller cities, it would also be uneconomic to make major changes. These mills have fairly large fixed capital investments, have no other alternative uses for these investments, and in the usual competitive situation produce milled rice for local commercial channels as efficiently as is

possible under the existing economic circumstances. The percentage of broken grains is high and the general quality of the rice produced is low because the economics of local markets favor this type of production. Such millers can be given assistance in the form of on-the-job training to improve sanitation, adjust equipment to produce a higher-quality product, control insects, and improve handling facilities. The quality equipment manufactured in the Philippines is satisfactory and new mills of this type will be needed as the rice industry expands.

For the production of high-quality rice to meet increasing demands in urban centers in the Philippines and for possible export markets, adjustments are essential in the 200 to 300 larger cono mills located in heavily-surplus areas such as Central Luzon and Mindanao. Here again, it is not desirable or feasible to junk these mills and replace them with more modern equipment.

The first simple adjustment in these larger terminal mills to make them competitive in quality rice markets would be to install simple classification, bulk milled-rice holding tanks, and re-mixing equipment. Such equipment is standard in mills in all exporting countries. With this equipment the operators could then take their existing machinery, use it to the fullest, and then supply urban centers and export markets with clean milled rice meeting definite broken-grain specifications while at the same time delivering to local markets lower-priced less restricted milled rice. With the local Philippine consumer up to now

being so tolerant of broken grains, much of the brokens removed to make export-quality could be re-mixed in the volume sold locally.

Even when imported, the cost of the classifying and re-mixing equipment would be relatively small. With sufficient demand,, these items can be made locally.

The second series of adjustments possible in these larger terminal mills involves changes in operating procedures. After the first hulling, the mixed hulls, hulled grains, and small broken grains are moved to the shaker-separator. This equipment separates the hulls from the hulled grain and takes out the small broken grains. The hulled grain,. in effect third-class milling by Philippine standards, is then moved to the polisher where it is further milled to remove the outer bran layers.

In the initial hulling, if the huller is adjusted tight enough to hull all grains, there is excessive breakage. Thus, the usual process is to adjust it so that this excessive breakage does not occur: In doing so, some of the palay grains are not hulled, especially the off-size ones. This proportion varies from 5 to 25 per cent, depending on the quality and uniformity of the palay and the adjustment of the huller. In the shaker-separator, this unhulled palay is also removed from the hulled grain. The standard practice in most mills in the Philippines is to divert this palay back to one of the two initial hullers. This practice reduces the volume that the huller can mill and at the same

time re-introduces off-sized palay to result in higher than average breakage. In efficient commercial mills, this problem is solved by installing a third huller, a smaller one with slightly tighter adjustments, to hull the unhulled palay from the first run. This permits more careful hulling of off-sized palay, resulting in less breakage, and at the same time increases the milling capacity of the unit by 10 to 20 per cent.

In the operation of the polishers, although the mills were designed to operate the usual two polishers in tandem, with the first one doing the rough polishing and the second, adjusted slightly finer, completing the job, the usual practice observed was to follow a one-pass polishing operation. The usual justification was that this practice resulted in less broken grains. Although current recommendations for standard cono mills are to the effect that best quality polished rice is obtained when a series of three polishers are used in tandem, the one mill visited that initially followed this practice shifted back to a tandem of two polishers because of excessive broken grains.

To produce highly-milled creamy-white milled rice acceptable on world markets, the usual single-pass polisher practices must be changed to the two-or three-polisher in tandem system. With the quality of the palay available, this is likely to increase the percentage of broken grains, but this must be expected if export quality is to be

produced. The broken grains then must be removed and sold locally.

For any new mills constructed in large surplus areas such as Central Luzon and Mindanao, consideration should be given to shifting to a more modern mill type featuring rubber-roller shellers and the smaller more compact horizontal 3-tandem polishers followed by a leather-flap whitener. In the last 10 years, more than 90 per cent of the United States rice industry has replaced its standard cone-type mills with this type of equipment. The United States industry purchased most of this equipment from Japan. However, this modern equipment featuring rubber-roller shellers and improved polishers along with complete classification and re-mixing equipment is now being manufactured in Japan, Taiwan, and Germany so there is a choice as to where it can be obtained.

Early experience in the Philippines in the use of rubber-roller mills was not satisfactory. This experience has prejudiced many people against such equipment. The disadvantages of the initial equipment, including staining the rice from the wear of the rollers, the rollers wearing out too fast and being too expensive, have been largely eliminated. Two rubber-roller mills were visited. In both plants, the quality of the rice produced was definitely superior to that from the standard or even the best cono mills. One operator reported he was obtaining a yield of 85 to 90 per cent whole-grain rice from a total yield of 70 per cent by weight, and the other

reported he was obtaining 65 per cent whole rice and 6 per cent brokens, or a total yield of 71 per cent from good palay. These results are similar to those that have been obtained recently in India and in Pakistan. Generally, from palay that will produce a total of 65 to 66 per cent by weight of total rice with 30 per cent broken grains in a usual cono mill, the production will be 70 to 72 per cent by weight of total rice and only 10 per cent broken grains in a modern rubber-roller mill.

The fact that the rubber rollers wear out frequently, and must be imported is a consideration but is not as serious as some anticipate. Changing the roller is a simple operation, the rollers are not expensive, and they can be easily stock-piled. Also, discussions with various Philippine rice-mill machinery manufacturers has led to the conclusion that such equipment, including the rollers, could be manufactured in the Philippines once there is a demand for it. The same is true for all of the classification, bulk-storage, and re-mixing equipment that is needed for the high-quality rice system.

It is not recommended that the cono mills in the Philippines be abandoned. There will be a need for such mills for many years and additional new mills will be required. It is recommended that for new installations to serve increased production in surplus areas where exports are a possibility, careful consideration should be given to the more modern rubber-roller types.

Improvements in Drying Practices

A large part of the rice quality problem is due to improper drying of palay. Poorly-dried palay produces a large percentage of broken grains, discolored grains, and off-type odors. Even the best of mills cannot improve low quality palay delivered for milling. High quality rice is a combination of two factors, good palay and efficient milling.

Much of the rice produced in the Philippines is harvested at the end of the rainy season, partly dried while stacked in the field before threshing, and the drying completed after threshing on sun or solar drying floors. Although this method of drying has some disadvantages, it does produce a reasonably good quality of palay if the operation is handled with care. The palay quality handled this way is not the best because the change in temperatures from day to night while stacked in the field along with over-drying of part of the stack cause checking or breaking of some grains. Uneven heat on the solar drying floor causes additional checking and discoloration in some cases. However, this drying method is inexpensive, is fairly satisfactory and, therefore, will be used for many years.

With the development of the non-seasonal new varieties and the expansion of irrigation systems so that rice can be planted and harvested throughout the year, new drying problems have developed. Drying rice during the rainy season on the traditional sun-drying patios is

almost impossible and if it is finally accomplished, the frequent soaking of the grain before it is finally dried results in a sun-checked discolored odorous product that has little commercial value and is impossible to sell in quality-demanding markets. Some type of artificial drying is needed if maximum advantage is to be gained from the new varieties and improved irrigation.

Here again responsible Philippine leadership has recognized this need and artificial dryers have been brought into the rice regions. Every type of rice dryer used anywhere in the world was found in the Philippines. <u>However, not a single dryer was being properly operated</u> to produce export-quality rice. Indeed, there seemed to be inadequate operator knowledge as to how to operate the driers.

To produce palay of the highest-possible quality, it should be cut and threshed before the moisture content of the grain falls to 20 per cent, and preferably at the 22 to 25 per cent moisture content. If it is permitted to dry in the field below this level, heat-damage in the grains occurs resulting in some breakage and discoloration. After threshing, the drying process should be started immediately and in no case delayed longer than 12 hours, or overheating and fermentation begins. The objective in rice drying is to reduce the moisture content to 14 per cent or below (safe storage and best milling are at 13.5 per cent) so that it can then be stored safely until milled. In contrast to all other grains, such as corn, wheat, or grain sorghum, the drying process in rice must be slow so that the grains are not broken internally

as the moisture is removed. Thus, rice drying in all of the commercial mechanized areas of the world where rice drying is accomplished in artificial dryers is done in stages of from two to five passes, with an interval of 24 to 48 hours between each pass, so that the grain may temper and the moisture equilibrium in the grain be reestablished. At each pass, the moisture content of the grain is reduced no more than 3 to 4 per cent before it is moved into a holding bin to temper before the next pass.

Although several well-built potentially efficient rice dryers of different types were seen, not a single one was being operated on a multi-pass basis with tempering between passes. Also, those being operated were generally maintained at a much higher temperature than is safe for quality palay. The usual practice was to run the palay through the dryer continuously at air temperatures of around 140 degrees F. for as long as it takes to reduce the moisture from the initial level of 20 per cent or more to less than 14 per cent.

This practice produced palay safe for storage but at the same time produced palay that was discolored, smelly, and had high breakage when milled.

The universal complaint about artificial dryers was that when the palay was milled it never was as white in color as palay dried in the sun. If the dryers are operated properly, the reverse will be the case. Recent research in India with multi-pass artificial dryers indicated that in both the wet and the dry season, these dryers produced

palay with less breakage and a brighter color when milled than conventional sun drying. The proper operation of the existing dryers in the Philippines will require some additional investment. Practically all of the dryers seen had not been equipped with adjoining holding tanks and mechanical bulk-moving equipment so that true multi-pass drying could be practiced. The addition of such holding tanks and conveyor equipment will greatly improve the efficiency of the units.

Some of the dryers seen were in reality corn dryers and not rice dryers, and this attempt to do two different jobs with the same equipment was not very successful. In corn, grain breakage does not matter and the larger-grains fit more loosely so that easier circulation of hot air is possible. Thus, corn is much better adapted to the many different batch dryers. For rice in some of these representative corn dryers, the operators reported the palay moisture content was as low as 10 per cent at the bottom. Uneven drying produced very poor quality palay. The bottom grains were cooked while the top grains were too wet to store.

It should be kept in mind that while conventional rice dryers can be used to dry corn, many types of corn dryers will not do a satisfactory job of drying rice. This means that where both grains are to be dried in the same equipment, the problem of first importance is to be sure that the equipment is adapted to rice.

The type of rice dryer that is generally accepted as best for drying rice is the so-called LSU mixing-type dryer. This type provides

for a continual mixing of the palay as it moves downward through hot air, and gives uniform heat to all grains. This type of dryer is now being manufactured by several companies in the Philippines and need not be imported. The mixing-type columnar drier with baffles and the conventional straight columnar flow dryer are also used to dry rice and when properly managed do a creditable job. Under certain conditions, the batch dryer in which heated air is blown up through the rice or out into the rice from a central chamber also does an efficient job. Batch driers have the disadvantage, however, that the process is slower than the columnar drier approach and if the process is intensified to reduce time, the non-moving grains nearest the heat are over-heated while those most distant are not properly dried. Also, heat to this extent greatly reduces the germination. Thus such rice is not satisfactory as seed. Batch dryers are used by some farmers in the United States and in Latin America where they harvest only one crop a year and have one to two months time to dry their rice. They use only slightly heated air, and under low-humidity conditions no heat to gradually dry the rice in place and then leave it in the same tanks which serve as both dryers and bodegas. For rapid drying of large volumes of palay in a short period of time, batch dryers are not likely to be successful in the Philippines.

Changing Storage Methods

Practically all of the palay moving into commercial channels

in the Philippines is stored in bags in flat warehouses. This practice has been economic and reasonably efficient for many years. Under proper sanitary conditions and careful management to keep down insect and rodent attacks, it is still a satisfactory way to store palay.

With rapidly increasing production of rice in the Philippines, however, a new set of circumstances has developed. A larger and larger volume of palay must be stored and it must be kept for a longer and longer period of time. Under such conditions, consideration should be given to bulk silo-type storage for any new facilities established. Bulk-storage in volume has many advantages; the cost of sacks is eliminated, the costs of man labor in handling are reduced, insect protection is much more effective, and with proper conveyors uniform treatment with insecticides is much easier and cheaper. The usual, large losses from rats are eliminated and, when attached to a mill, the costs of milling are reduced by bulk handling of the palay to the mill.

There have been some bad experiences in the Philippines in the bulk storage of rice. These have been due not to the system but to mistakes in management. The most frequent have been losses due to germination or fermentation in storage, because the palay was not properly dried. Succesful silo-storage depends on proper drying. Other losses have occurred because hot-spots developed in the bulk grain or insect attacks occurred, and these were not found soon enough to take proper control measures. Bulk units equipped with relatively

inexpensive temperature indicators, and with proper moving or turning equipment, will not develop these difficulties.

The many flat warehouses available represent a large investment and should be used for rice storage for many years. For some of these, however, a transition from sack to bulk storage is possible. A series of partitions and simple conveying equipment installed near the roof to place the palay in the bins and on the bottom to move it out or to other bins will make a sack warehouse a fairly efficient bulk storage unit, especially if the palay is to be kept for only 3 to 6 months. This practice has been followed for many years in Burma, but without the mechanized conveyors, and is now being followed in some areas of Latin America. For periods of storage for 6 months or longer, it is not recommended because the danger of insect contamination is too great. In any event, it can be successful only if the rice is properly dried before storage.

Programming Varieties Produced

The efficient milling and orderly marketing of rice in the Philippines is likely to be retarded, especially at the urban and export level, until the number of varieties commercially grown is greatly reduced. In retail markets in major cities, it was commonplace to find from 30 to 50 different varieties of rice on sale, each with some distinguishing characteristic such as color, odor, grain size, and translucency. In the mills visited

it was common to see 10 to 15 different varieties being dried in small lots on the same drying floor. In a given area, millers reported that in a season they commonly milled up to 30 different varieties. The millers interviewed reported that one of their most serious problems affecting rice quality was the large number of different varieties they had to mill, each with differing grain length, grain width, hulling characteristics, breakage stresses, and hull fuzz, so that the proper adjustment of the hullers and the polishers is very difficult.

These objections are well founded. Adjustments must be made in spacings of rice hullers and polishers for each different type of grain. In some cases this is a trial and error program taking several hours to get the proper settings. If changes have to be made frequently, the process must be started over again each time with the resulting loss in time and in damaged grain until the optimum setting is determined. For mixed varieties this is almost impossible, which is why the broken-grain content of mixtures is always high.

For the United States industry as a whole, only 6 varieties make up more than 90 per cent of total production. In a given production area such as California or Texas, 3 varieties are the maximum. Most mills specialize in the milling of only 2 or 3 varieties and frequently they assign specific machines for each variety and are used for no other types. Similar specialization is characteristic of the commercial rice-exporting areas in Egypt, Australia, Italy, Venezuela, Guyana, and Surinam.

In a large per-capita consumption rice area such as the Philippines, where much of the rice is produced first for home consumption and only the surplus over home needs placed on the commercial market, it will be extremely difficult to reduce the large number of different varieties. Individuals consuming a large volume of rice every day soon develop distinct taste preferences that so far the casual consumer of rice or the chemist has not been able to identify. It will be impossible, therefore, to greatly reduce the number of varieties in the Philippines during the next several years. The number of varieties moving into commercial channels and through export-type mills, however, can be controlled. This can be done by first determining the best varieties for a given surplus-production area, making sure that seed of these varieties, is available, and then announcing that these are only the ones that will be purchased.

In the long run, the number of varieties will only be reduced by price incentives. This will involve millers paying sufficiently high prices for the varieties having export-quality characteristics and paying lower prices for those of limited value for export. An annual appraisal by a competent commission to announce the approved varieties and suggest price premiums would help in this respect.

Implementation of Quality Standards

Standards for milled rice in the Philippines were prepared for the Bureau of Standards in 1960 by a 12-man technical committee.

These standards represent an excellent start towards encouraging the production of quality rice of known characteristics so that sales can be on the basis of known published grades rather than slight examination for each lot.

These standards, however, have not been implemented in the absence of adequate price incentives. To apply them to the trade, regional laboratory-grading offices are needed where trained graders can analyze samples and provide an objective repeatable classification for each sample. A start has been made in this direction with the establishment of the quality laboratory in the RCA building in Manila with the assistance and supervision of The Food and Agriculture Organization of the United Nations. This laboratory should be expanded, additional training programs provided, and as people are trained to pull samples and grade milled rice, regional laboratories should be established.

Initially, the grading process should be on a demonstration volunteer basis. After experience is gained, then the entire support-price structure or payment structure to millers for processing RCA palay should be placed on a grade basis. Then as the private trade begins to understand the grades and develop confidence in their objectivity, they should be encouraged to trade by grades for both home and export sales. This process may take ten years but it is essential to organizing an efficient stable commercial trade in rice.

In reviewing the milled rice standards established in 1968, it was noted that standards differ from grades no. 1 through 5 for

Philippine rice and United States rice moving in international markets. These differences are shown in Table 2 for grades 1 and 3.

Table 2

Comparison of Philippine and United States Grade Standards for Rice

Grade	Percentage Tolerance	
	Philippines	United States
No. 1		
Broken grain tolerance	10	4
Tolerance of other varieties	2	1
No. 3		
Broken grain tolerance	30	15
Tolerance of chalky kernels	15	6
Tolerance of other varieties	5	3

These differences are not important so long as they are understood, but if a Philippine exporter sold rice based on the Philippine grade while the importer thought he was buying according to the U.S. grade, there would be major problems.

Once the grading system for milled rice is established, understood, and respected, a similar grading system for palay should be established. Growers can be trained to produce high-quality palay, well dried and free of mixtures, only if they see

the differences from their neighbor's palay in terms of prices. Once palay is purchased by the private trade or by government by clearly recognizable grades, farmers will be quick to improve quality assuming that price differences exist.

An Education Program for Millers and Bodega Managers

The concept of an agricultural extension service for farmers, in which a trained but practical agent visits farm after farm and holds meetings in the community to teach farmers improved methods is well accepted in the Philippines. This approach has been a major factor in obtaining the recent increases in yields and improvement in living standards in the barrios. A similar program for rice millers and bodega managers is now needed.

As has been pointed out previously, the Philippines has all of the different types of dryers, bodegas, and rice mills that exist anywhere in the world. Also, all the technical know-how and mechanical ability to manufacture all these different types of units and the accessory equipment is in the country. However, very little of the existing experience with the different types of drying, storing, and milling equipment, or how to best operate this equipment, has moved to the majority of millers and bodega operators.

A key group of trained experienced rice mill specialists, rice dryer specialists, and others trained in insect and rodent control to serve as extension agents to the 10,000 rice millers and numerous dryer

and bodega units would in time make this industry much more efficient. Such a unit, tied to a research program in these areas, and with a small but effective research program applied to local problems, would make the extension education program more effective.

A program of this type was started in India three years ago. It has been very successful. Although India is not interested in rice exports as they are far from being self-sufficient, it was found that improvements in rice drying and storage, and the introduction of modern improved-type mills increased their total available rice by as much as 10 per cent. The program started with one foreign expert and there is still only one non-native on the job. With the Indian Government and private industry making available good men who could be and were trained, the program has expanded to 6 field men and a training program in rice milling and drying that trains 20 industry people every 6 months. It has resulted in the construction of 30 modern rubber-roller complete rice mills in the 500 to 1000 cavan per 12-hour capacity range. Similar results may be possible in the Philippines.

Adjustments in Under-Utilized Resources

In the area of rice drying and storage, there are certain under-utilized resources that by their very existence and lack of use discourage others to move to make improvements. The RCA owns large bulk storage and mechanical dryer facilities located in Digos, Davao, and Camalaniugan, Cagayan. The Digos facility was visited

and the other one was reported to be in about the same condition. These are large silo-type storage units with a capacity larger than any other others seen in the country, made of wooden staves held together with steel bands. The Digos facility had not been used since 1963 and the Camalaniugan facility was reported as not being used since 1958.

With lack of use these units have deteriorated badly. They are of no use to RCA and only serve as a cost in terms of maintenance and security. Although they will have to be sold at a loss, it would be better to take a loss now as they depreciate more and more every year. If advertised to the highest bidder, and thus turned over to private enterprise to renovate and use in storing and drying, or to be salvaged as junk, this would be a better move than to leave them standing as a monument to past mistakes. It is not important as to why this situation exists; it is important to salvage what is left.

In addition, the ACA owns two bulk facilities, both of bolted steel construction, which are located in Solano, Nueva Vizcaya, and San Jose, Nueva Ecija. The San Jose plant was visited and the Solano unit was reported to be in the same condition. These units were built in 1954 but have had little use since about 1960. Deterioration has continued but the storage tanks, at least, appear salvageable. Here again, such monuments, unused and rusting away, discourage local

private enterprise to attempt to start bulk drying and storage operations. These units should be re-activated if there is a real need for them in the area and if not, sold to the highest bidder for whatever use can be made of them.

Price Policy

The opportunities for the Philippine rice industry to compete for world export markets in the 1970's will depend greatly on basic agricultural price policy. The economic objectives and problems of specific agricultural price policy programs are an integral part of the overall rice marketing picture and must be considered in evaluating export prospects.

In recent years and currently, the basic target price support for palay has been 16 to 17 pesos per 44-kilo cavan of palay. At the official peso rate of approximately 4 to 1, this amounts to around U.S. $4.00 per 100 pounds. At the international buying-power rate of the peso, about 5 to 1, this would amount to about $3.20 per hundred weight (100 lbs.).

At the official exchange rate, this price-support level is slightly lower than the United States rice price support level of $4.50 per hundred weight but considering the difference in the average quality of palay sold, is about the same. This support level is considerably higher than the support level or current grower prices in Thailand, Burma, and Pakistan. These countries are the major exporters of the region with which the Philippines must compete in exporting rice.

The wholesale price of milled rice in the Manila area currently is from 44 pesos to 51 pesos per 56-kilo cavan. This amounts to nearly U.S. $10.00 per hundred weight or $210 per metric ton at the official peso rate, or almost $8.00 per hundred weight or $170 per metric ton at the international peso rate. As of early October, 1969, top-quality long-grain 5 per cent broken rice was selling f.o.b. ports in Thailand and in the United States at around $200 per metric ton. Low-quality types, comparable to the better rice now being sold in Manila, were selling for about $140 per metric ton.

At the international exchange rate for the peso, the wholesale price of rice in the Manila area is, as of October 1969, about 20 per cent higher than world wholesale prices for rice. Even considering the fact that the seasonal high in rice prices in the Manila area is usually reached in October, when the prices average 5 to 10 per cent higher than average, the Manila wholesale price for rice is still considerably above world prices.

At the retail level, the average price paid by consumers in the Manila area in October 1969 was from 2.00 to 2.20 pesos per ganta of approximately 5 pounds, or about U.S. $0.11 per pound at the official rate or $0.09 per pound at the international rate. At the international peso rate, this is slightly lower than the usual price

paid by consumers of rice in the United States or in Europe. Wholesale prices in the Philippines, therefore, are equal to or higher than United States prices, retail prices are slightly lower. This is due to a smaller price spread between the wholesale price and the retail price in the Philippines than in the United States. The retail price for rice in the Philippines, however, is about double the price paid by consumers in the exporting countries of Thailand, Burma, and Pakistan.

Philippine laws require that RCA make available to low-income consumers in the open market second class milling milled rice (which is greatly under-milled rice) at 1.40 pesos per ganta. The quality of the second class milling leaves something to be desired, and most consumers interviewed expressed a definite preference for the higher-priced better-milled types selling from 1.80 to 2.20 per ganta. However, it is quite possible that this floor price does set the tone of the retail rice markets and that without it, prices for the higher quality types might be higher.

If the current price levels and price differentials are reasonably representative of normal conditions, the following observations follow:

1. The current support price of 16 to 17 pesos per cavan of palay as compared with the controlled retail price minimum of 1.40 pesos per ganta results in a substantial subsidy to the grower, or the consumer, or both. The absolute amount of the subsidy depends on the

costs of buying, storing, transporting, selling, and administration, which were not within the scope of this study.

2. At the present support level, milled rice could only be exported at a loss. At this price, milled rice of acceptable export quality, f.o.b. major ports, could be obtained at from 40 pesos to 45 pesos per cavan; this would amount to $150 to $180 per metric ton. Current international prices for this rice, when some of the excessive broken grains are removed, would be $140 to $150 per ton. A subsidy of up to $20 per ton would be required. This would mean 4 to 6 pesos per cavan of milled rice exported.

3. At projected world prices for rice for the next few years of $120 to $140 per metric ton for medium-quality rice and $160 to $180 per ton for high-quality rice, a maximum palay price of between 12 and 15 pesos per cavan at the mill would be needed to break even, with the price depending on the grain type and quality of the palay.

The alternatives are:

A. To permit the price of palay to fall to the level that will provide free and unrestricted competition at world export prices. This could only continue if the yields are high enough that the growers can make a profit at this level and thus continue and expand the volume produced, and the commercial rice trade is efficient enough to reduce costs and improve quality to take their part of this per-unit price reduction.

B. To export rice on competitive rice markets while holding the domestic market price at or near current levels. This would mean a government subsidy estimated at 4 to 6 pesos per cavan of milled rice exported.

C. Attempt to maintain a position of self-sufficiency in rice, maintaining some buffer stocks for lean periods, but as the rice yields per hectare increase, encourage diversion of marginal rice lands to other uses.

In some respects the Philippines is in a more favorable position to take the first alternative than most other countries in the area. For some unknown reason, pests and diseases, although serious, are not as disastrous as in some other regions. There is a viable commercial fertilizer industry, fertilizers are not subsidized, and other inputs are available. Mechanization on small farms and the development of mechanized large farms has moved farther and faster than in any of the other countries of the region, excluding Japan. There is a small but growing local equipment manufacturing industry to service expansion. Research and training centers and extension education programs are more developed than in nearby countries. In some parts of the nation, there is still additional land to be developed. All of these advantages do not exist at the same level of opportunity in the other countries of the area. However, if world rice prices decline to lower levels than the estimates herein, then even with

these advantages, expansion of rice production beyond domestic needs may be marginal.

On the domestic level, regardless of exports, rice price policy makers are faced with problems. At the levels at which palay prices have been supported, and at the levels at which milled rice has been sold by RCA to maintain the prices of rice at retail of 1.40 pesos per ganta for second class milling, losses have occurred. These losses, including purchase, storage, transportation, and administration, have been reported to amount to millions of pesos annually.

The alternatives here are: 1) to maintain the current policy and continue to absorb the losses, 2) to increase the price to the consumer to the point all losses are covered, 3) to decrease the price to the farmer to the point all losses are covered, 4) to adjust in both directions, reducing the farm support price and increasing the consumer price and thus making a smaller change in each direction to cover the deficit, or 5) for the government to get out of the rice business completely and let prices at all levels be determined by the forces of supply and demand in the private sector.

At the price at which RCA officials are required to purchase palay, 16 pesos, this amounts to a cost per cavan of milled rice of 37 pesos per cavan. At the price they must sell this rice, 1.40 pesos

per ganta at retail, this amounts to 30 pesos per cavan (1.30 pesos per ganta wholesale since the margin to the retailer is .10 peso per ganta). Thus, before paying any costs for storage, handling, freight, insurance, and other marketing expenses, the net loss is 7 pesos per cavan of milled rice or 4 pesos per cavan of palay. To break even without considering marketing costs, using the intermediate approach, the basic price for palay would need to be reduced 2 pesos per cavan and the retail price increased .15 peso per ganta. This would make the palay price 14 pesos per cavan, and the retail price 1.55 per ganta. A change in the law would be necessary to adjust to these prices.

Problems in Exporting Rice

The business of exporting rice is a highly-involved, technical operation. Most exporters have been involved in the trade for many years and have gradually developed their contacts, and understanding of what it takes to sell and ship rice abroad, collect the income, and keep customers happy so there will be repeat business. This requires contacts in the many countries where sales are possible, daily knowledge as to the production, marketing, and business conditions in these countries, lines of credit, the development of confidence in customers that deliveries will be on time and in the volume and of the quality specified, how to use international inspection services and international arbitration

services when needed, and the many lines of communication that are essential to international trade. These skills are not learned overnight. It is likely to take years to develop this needed ability in a country that has not been a constant exporter in the past. Early mistakes can be costly.

Usually, most nations build up this commercial network gradually over a period of years, shipping a small volume the first year and then over 5 to 10 years build up contacts, communications, and mutual confidence. With the continued rapid increase in rice production in the Philippines, there may be no time for this gradual approach.

There are several international grain marketing. companies that have numerous contacts in all major countries and with all major transportation, storage, financing, and international sales agencies. It is possible that in the first few years of exporting rice that the Philippines might wish to employ the services of one of these companies to assist in moving the initial crops and in training the local trade. These companies are free-enterprise organizations and are in the business to make money and they, therefore, will charge a fee for such assistance. It is usually a minimum fixed-fee guarantee plus a small percentage of the sales with the percentage applying to the guarantee when the volume

reaches the designated level. Competitive bidding by several organizations is likely to keep the cost of service at a reasonable level.

In addition to international arrangements, the other major problem in exporting rice is quality control. All different qualities of rice are commonly bought and sold, but no customer wants to receive a quality lower than that he thought he was purchasing. Some countries, such as Guyana, have established a central Government Rice Marketing Board and by law this board is the only one permitted to export rice. This Board has a large rice mill and reprocessing plant in which low quality rice is purchased from millers, re-milled, cleaned, and repacked, and then shipped. This approach is expensive and leads to centralization and inefficiency and should be followed only as a last resort. Other countries require export permits from private dealers, a copy of the specifications indicating the quality in the contract, and then have government inspectors to check the rice as it is loaded on the ships to insure the quality is as specified. This works so long as the inspectors are honest. Other countries employ international inspection firms to check the shipments on both the shipping and the receiving end. To build confidence in Philippine export rice, any initial exports should be handled by one of these approaches. In the long run, experience and the mutual confidence between buyer and seller will solve these problems. The firm that delivers quality as specified or better gets repeat customers.

Summary of Recommendations for Equipment Usage

As indicated previously, the several different types of equipment used in various phases of the commercial rice industry are available in the Philippines. In many cases, however, the relative contributions of the different types and the proper use of each is not well known or understood. There are technical, engineering, and management problems in drying, storing, and milling.

Drying

Most of the palay grown is dried on what is termed a "sun dryer," "solar dryer," or "cement dryer." This consists of a cement floor over which the palay is spread evenly and turned occasionally by running a wooden shovel or similar tool through the grain. This system enables the operator to lower the moisture content of the grain from the initial level varying from 22 to 28 per cent down to 14 per cent in 4 to 8 hours depending on the original moisture content of the grain and the intensity of the sun. Cement dryers are popular because they require a minimum initial investment, and the only operating costs are the labor in moving the grain.

This system of drying, however, will never permit the miller to obtain the highest possible yield of good-quality whole grain or head rice from palay. In the Philippines in the past this consideration was not of much importance because local consumers did not object

to broken grains or occasional stained grains. However, in the future a higher quality will be required to supply a more exacting urban demand and for export markets.

Improved quality palay can only be obtained by the proper use of mechanical dryers. As additional land is put under irrigation and the non-seasonal varieties become more important, the use of mechanical dryers will become more and more essential. They will be absolutely necessary for good-quality palay harvested in the wet season.

It is a common belief among millers that sun drying produces a whiter rice due to what they consider to be a bleaching effect of the sun. Also, they reported that in the few mechanical dryers now in use, no improvement in palay quality was observed over palay dried in the sun. However, not one of the mechanical dryers inspected was being used properly.

No consideration had been given to the need for tempering between passes and holding the air temperature within permissible limits. An apparent need exists to train dryer operators in the proper use of their equipment. A training program in this area is an urgent need.

Most of the dryers inspected were of the vertical or columnar-flow type. A simple system of three tempering bins would complement

these installations so as to allow proper operation of the equipment. The normal procedure is to allow the rice to pass through the dryer with an air temperature of 110 degrees Farenheit. The rate of flow through the dryer is adjusted so as to extract about 3 per cent moisture from the grain per pass. Three passes through the dryer are generally required to reduce the moisture content from 22 per cent to 12 or 13 per cent for safe storage. During the first pass a temperature as high as 130 degrees F. may be used without causing undue stresses and strains in the structure of the kernel caused by differences in moisture levels between the outer and inner portions of the kernel. For the next two passes, a maximum temperature of only 110 degrees F. is desirable. After each pass through the dryer the palay should be held from 12 to 24 hours in one of the tempering bins to allow the moisture to equalize throughout the kernels. This step. tempering, after reducing moisture levels only 3 to 4 per cent in each pass, is the key to obtaining the best whole or head rice recovery.

The common practice followed in the dryers inspected was to dry the grain continuously, reducing the moisture from 22 to 24 per cent down to 14 per cent with no tempering period betwen passes. Temperatures much higher than the 110 to 130 degree F. maximum were being used. This approach causes a checking of the grain, high breakage when milled, and off-color rice.

To convince the miller of the importance of proper drying, tests should be conducted at the different locations where mechanical drying installations exist. These tests should include milling tests of properly dried palay as compared with sun-drying and with mechanical dryers where no consideration has been given to tempering or temperature control.

Milling

At the present time, market requirements are not very demanding and millers are producing rice with anywhere from 30 to 50 per cent broken grains. In the milling operation only the fine brokens, or "binlid" are removed from the rice. No special effort is made to recover the highest possible head rice percentage from palay. Mostly composition-stone type hullers and "cono" type whiteners are used. In general, only one pass through a whitener or polisher is being used to achieve the desired milling grade. As a result, the product has a high percentage of broken grains.

Most of the mills inspected could be improved or adjusted if the market demanded a uniform product with a fixed amount of brokens. This could be done simply by installing a grader so as to be able to separate the small and large broken grains from the head rice. A volumetric mixer would also be highly desirable in order to deliver a uniform product.

The millers would still be faced with the problem of producing the highest possible amount of head rice from available palay. Serious consideration should be given to the use of rubber roller hullers to substitute for the stone hullers. Rubber-roller hullers on the average produce from 2 to 4 per cent higher total yield and only about one-half the broken grains from a given quality palay as the stone hullers. In export markets, head rice brings two to three times the price of brokens. This trend is expected to develop gradually in the Philippines as consumers in urban areas become more discriminating. The additional cost of adding rubber roller hullers will be offset by the additional total recovery and the higher proportion of head rice obtained.

Multiple-pass whitening and polishing would be the next step to consider in improving rice milling. Instead of trying to achieve the desired color in one step, the use of two or three whiteners in a series has proven to be the best method of reducing the amount of broken grains.

The small "kiskisan" mill of the Engelberg design plays an important part in the overall picture of the Philippine rice industry. In these mills it is estimated that about 50 per cent of the total rice crop is processed. Of the 10,000 mills in the country, more then 6,000 are of this type. Their capacity is usually only 3 to 5 cavans

per hour and the end product contains 50 per cent or more broken grains. This rice is consumed mostly on the farms and in the local villages. The small investment makes these mills practical in rural areas. Local manufacturers are offering new small "cono" type mills which even though more expensive than the kiskisan mills will probably slowly replace them as their increased recovery rate from palay proves them more profitable to operate.

In commercial milling, larger-volume mills generally produce at a lower cost per unit. As the Philippine industry expands, the need will arise to install equipment milling up to ten tons of palay per hour. Because of the lack of transportation facilities and the wide distribution of the production areas, larger mills than this level may not prove feasible. The new mills installed, however, should include the necessary equipment to produce the highest-possible percentage of head rice along with proper grading and volumetric mixers.

Storage

Most of the palay moving into commercial channels is stored in sacks. To save on sack costs, and in the labor involved in handling, most of the flat warehouses now used for sack storage could be converted into bulk storage. In the typical flat warehouse observed, a screw conveyor could be installed in the upper structure of the building to transport the grain to any desired location in the warehouse. Then

a portable screw-conveyor could be used to handle the grain from the floor up to the main upper conveyor in loading, unloading into bulk containers, movement direct to the mill, or for sacking.

In some instances bucket elevators could be used instead of portable screw conveyors to load the main upper screw conveyors. The individual design would vary according to the particular demands of the storage unit. Most of the equipment required to convert the flat warehouses from sack storage to bulk storage could be manufactured locally with a considerable saving in foreign exchange.

Bulk storage will increase the capacity of flat warehouses by at least 20 per cent. To prevent heat and insect damage, it is advisable to store the palay at 12 to 13 per cent moisture content. The standard practice observed in the warehouses visited was to store at 14 to 16 per cent moisture content and as a result there were frequent examples of grain deterioration.

Properly dried palay can be kept safely in bulk storage at hot, humid temperatures, such as exist in the Philippines, without aeration for up to three months. It is advisable to install a simple system of aeration if the grain is to be stored for longer periods of time. These aeration units could be designed using a portable duct system which could be removed if the warehouse was to be used for sack storage or any other purpose. The duct system could be manufactured

locally as well as the fans used in the aeration process.

Brown rice and milled rice are more perishable and should be moved to the consumer as soon as possible after milling in order to prevent losses. Although rice is frequently stored as brown rice in Japan, Taiwan and South Korea, the temperature conditions and relative humidity in the Philippines are such that this is dangerous, and if practiced is likely to result in substantial losses.

As rice production continues to increase in the Philippines, additional large bulk-storage units will be needed. To save on the cost of these units and to provide for future expansion, a simple in-line system should be chosen that insures a logical flow of grain. In silo storage design, considerable money can be saved by eliminating many of the refinements which basically are not required for efficient and safe grain storage and handling.

Several new storage units are now being built in the Philippines including a series of "Butler" type bins, batch dryers, and holding tanks. The equipment in these installations is good and the units will add considerably to the bulk storage capacity in the areas where constructed. However, for maximum efficiency in rice drying and storage, some improvements could be made.

The system of two batch dryers can be used in corn-producing areas. The disadvantage of using this type of dryer for rice is in obtaining uniform drying throughout the batch. In actual practice as

much as a five per cent moisture differential will be obtained between the bottom layer and the top layer of palay in the batch being dried. This is not critical for corn but in palay it could seriously affect the keeping quality of the palay and the milling yields obtained. Where rice is the main storage and drying objective, columnar dryers should be installed with these units.

To simplify the flow of grain in these units, it is suggested that the tempering bins and storage bins be placed in line. The portable high-speed screw conveyors which require high maintenance costs could be replaced by standard horizontal low-speed screw conveyors. Bucket elevators should be provided to load the columnar dryer and the top conveyors that will discharge into the storage and tempering bins. These units also need a palay cleaner before moving the palay to the dryer.